

A new species of *Boreus* (Mecoptera: Boreidae) from Vancouver Island, British Columbia

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ABSTRACT

Boreus insulanus Blades (Mecoptera: Boreidae), a new species from Vancouver Island, British Columbia, Canada, is described and distinguished from similar species using morphological characters and measurements. Similarities of male genitalic structures, the notched ninth sternum and male wings abruptly narrowed at the middle place this new species in the *brumalis* subgroup of the *nivoriundus* group of *Boreus* species. The *brumalis* subgroup currently includes *B. brumalis* Fitch, *B. nix* Carpenter, *B. pilosus* Carpenter, and *B. bomari* Byers. Characters that distinguish *Boreus insulanus* from these related species include: fine appressed hairs above the eyes, on the pronotum, and wings; absence of fine, erect hairs on pronotum, wing and abdominal sclerites; relative position and number of pronotal bristles (4 anterior; 4 posterior); and dark abdominal sclerites with a metallic green sheen. The distributional records for this new species indicate that it may be confined to Vancouver Island's interior mountain range.

INTRODUCTION

Species of *Boreus*, commonly called snow scorpionflies, inhabit mountainous regions of Europe, northern Asia, and North America. They are usually associated with mosses and are unusual in that the adults mate and disperse during the winter months (November to March) (Penny, 1977; Hagvar, 2001). Specimens are often collected on snow during sunny, warm days, but recent research on *B. hyemalis* (L.) shows that activity on the snow surface is greatest on windless, cloudy days and that most activity during the winter occurs in air pockets under the snow pack (Hagvar, 2001). Penny's (1977) comprehensive systematic study of the family provides detailed descriptions and taxonomy of the known species and the biology of the group. More specific studies on the biology of North American species include works by Cooper (1974), Shorthouse (1979), and Courtin *et al.* (1984). *Boreus* species described since 1977 include *B. jacutensis* Plutenko and *B. tardokijanensis* Plutenko from Russia (Plutenko, 1984; 1985), *B. jezoensis* Hori and Morimoto from Japan (Hori and Morimoto, 1996) and *B. bomari* Byers and Shaw from Wyoming, USA (Byers and Shaw, 1999).

This paper describes a new species of *Boreus* found in collections carried out by the author on private property at Camas Hill, Metchosin, on the southern tip of Vancouver Island, British Columbia (48° 23' 57" N 123° 35' 44" W). Specimens were collected using continuous pitfall trapping over a period of two years. Specimens of this new *Boreus* appeared in samples from January to March 2000, and November 2000 to March 2001. Literature research into the genus and inquiries to various collections in North America failed to uncover any records of *Boreus* from Vancouver Island (Penny, 1977; Blades, unpublished data). Searching of the Royal BC Museum collection uncovered two more specimens from Vancouver Island. Using Penny's (1977) key and descriptions, original descriptions (Carpenter, 1935), and literature on recently described species (Hori and Morimoto, 1996; Byers, 1999), I determined that these specimens represented a new species. This paper describes this new species of *Boreus* and provides diagnostic characters to distinguish it from other nearctic *Boreus*.

Specimens were examined in detail and compared using measurements and characteristics of external morphology. Measurements of overall body length were made but the obvious distension of the specimens limits the usefulness of this character in comparisons with other species, a problem also noted by Penny (1977). Instead, only lengths and ratios of rigid structures such as the head, eye, wing, ovipositor and dististyle were considered when making comparisons with other species. Characteristics of the male genitalia in the new species were similar to those of *B. pilosus* Carpenter and *B. nix* Carpenter. This similarity and the notched ninth sternum and male wings abruptly narrowed at the middle place this new species in the *brumalis* subgroup of the *nivoriundus* group of species as defined by Penny (1977). The *brumalis* subgroup includes *B. brumalis* Fitch, *B. nix*, *B. pilosus*, and *B. bomari* Byers (Penny 1977; Byers 1999). Twelve hundred and seventy eight specimens of ten related species (including paratypes) were obtained from various North American collections for additional comparisons.

SPECIES DESCRIPTION

Boreus insulanus n. sp.
(Figs. 1 to 7)

TYPE MATERIAL

Holotype male: Canada. British Columbia: Vancouver Island, Metchosin, summit of Camas Hill (293 m; 48° 23' 57" N 123° 35' 44" W), sample CH99-18P, yellow pantrap, 13 II to 13 III 2000, D. Blades, C. Reznechenko and L. Rosenblood. Deposited at the Royal British Columbia Museum (RBCM); specimen number ENT000-000314.

Paratypes: Same location as holotype. 2 males, 1 female, 3 I to 13 II 2000; 3 males, 13 II to 13 III 2000; 1 male, 5 to 13 XI 2000 deposited at RBCM; 3 males 13 II to 13 III 2000 deposited one at each of: The Snow Museum (RBCM #ENT000-000310), University of Kansas; the Canadian National Collection (CNC), Ottawa (RBCM #ENT000-000312); and the California Academy of Sciences, San Francisco (RBCM #ENT000-000309). Remaining specimens (6 males, 1 female; 9 XII 2000 to 8 III 2001) retained in author's collection, to be deposited at CNC by December 2004.

ADDITIONAL MATERIAL

Two female specimens with characteristics clearly matching those of type specimens: one from Goldstream, near Victoria (48° 23' N 123° 33' W; pinned) collected by G.A. Hardy, 7 III 1927 (RBCM #ENT991-164463); and one from north side of Mount Cokely at 1500 m, near Port Alberni (49° 14' 23" N 124° 35' 12" W; in alcohol) collected by S.G. Cannings, 23 IV 1995 (RBCM #ENT998-010684).

ADULTS

General: A large species of *Boreus*, length of males 3.9 to 6.6 mm (avg 4.7 mm) (Fig. 1) and females 5.4 to 6.0 mm (avg 5.8 mm) preserved in alcohol, 5.0 mm for pinned female (measured in lateral view from tip of ovipositor/sternum 9 of male to base of antenna). Abdominal sclerites, wings and occiput dark brown to almost black with a green metallic sheen. Thorax, legs and rostrum lighter, varying from tan to dark brown; the legs lighter in colour than thorax. Colours of pinned specimen similar to those in alcohol. Immature stages unknown. Terms used in this description follow those of Penny (1977) and Byers (1999); it is important to note that setae and bristles (=strong setae) possess ring-shaped

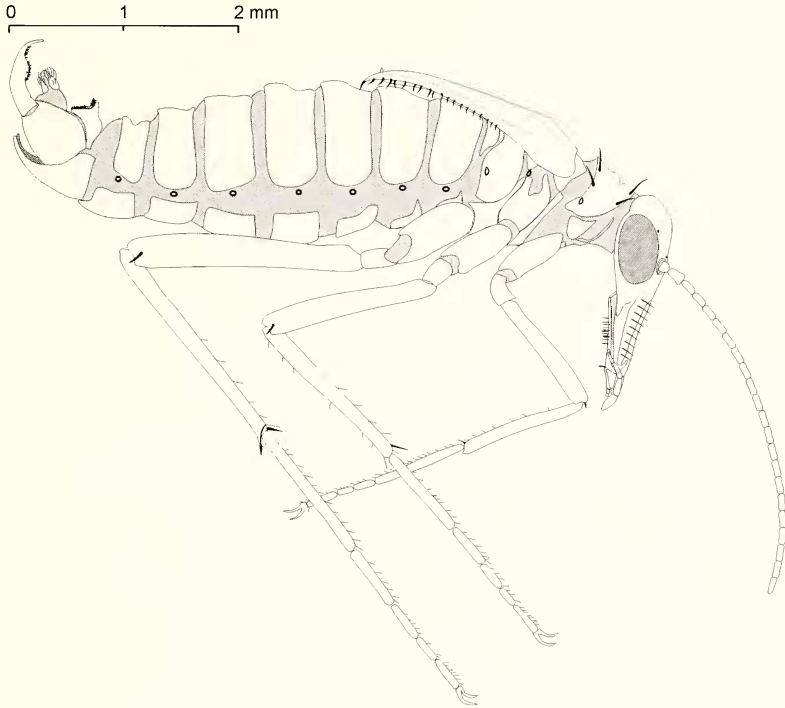
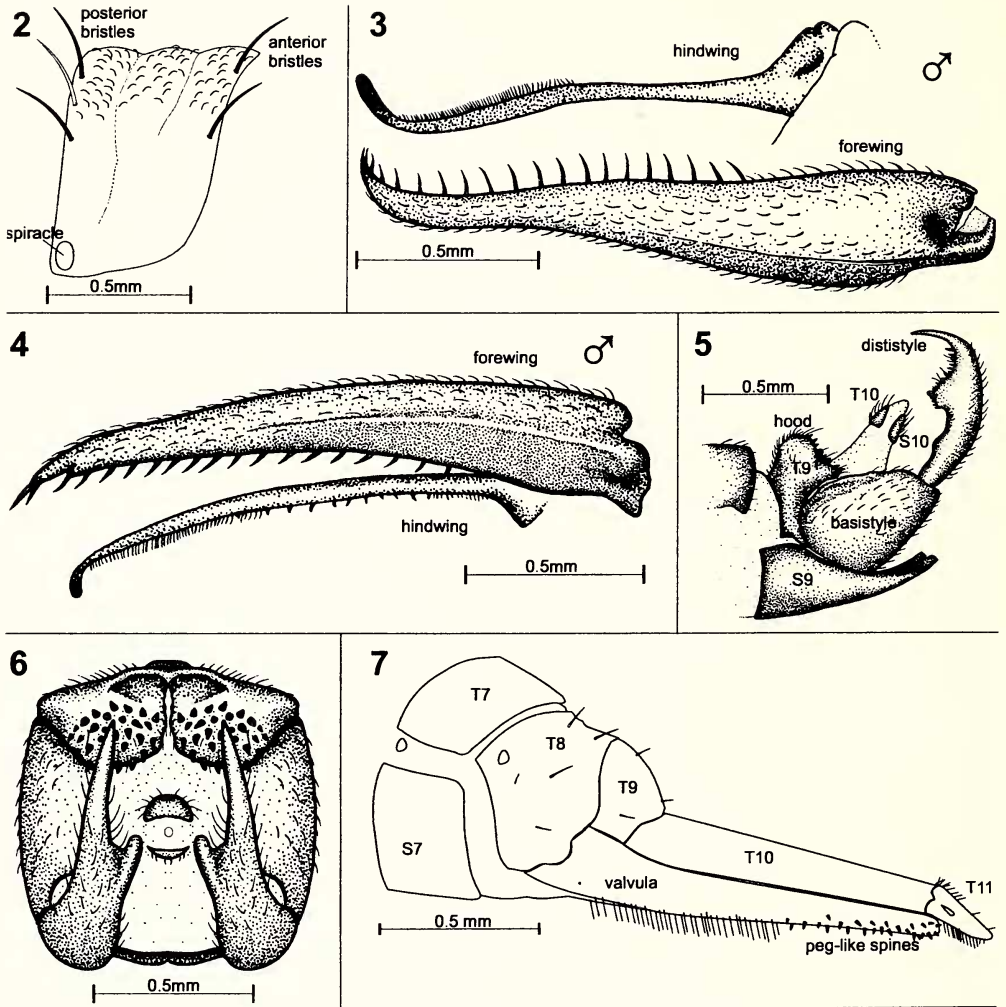


Figure 1. Lateral view of male *Boreus insulanus* indicating setae and bristles; hairs, and setae of palps, omitted.

basal sockets whereas hairs and spines do not.

Head: Head coloration dark from top of head to just below eyes on sides and down front of face almost to tip of rostrum. Lateral and posterior areas of rostrum tan to light brown; an abrupt, horizontal separation of light and dark colours just below eye when viewed in profile. Eyes reddish. Length of head from vertex to tip of rostrum: 1.57 to 2.00 mm (avg 1.81 mm) in males; 1.88 to 2.07 mm (avg 1.96 mm) in females. Diameter of eye measured in same direction as head: 0.50 to 0.68 mm (avg 0.62 mm) in males; 0.58 to 0.67 mm (avg 0.63 mm) in females. Ratio of maxillolabial complex to rostrum varies from 0.89 to 0.97 (avg 0.93) in male and from 0.85 to 0.93 (avg 0.88) in female. Occipital region glabrous, finely wrinkled and without hairs or setae. Area between eyes and occiput with short, fine, recurved hairs closely appressed to the head. Fine, erect, white hairs dominate the area between the eyes and below the antennal sockets. A few fine, pale, erect setae present on base of rostrum (frons) below antennal sockets (about 0.06 mm in length). A distinct row of 10-12 such setae in furrows (depressions) on either side of the otherwise bare midline of rostrum. Mentum with 12 to 20 or more setae similar in length, but slightly thicker, to those in lateral furrows; situated primarily in basal half, with two near distal margin. Lateral ocelli nearly touching compound eyes with smaller median ocellus present near bases of antennae. Antennae brown; with 20 to 22 (mode=20) flagellar segments in males; 19 to 21 (mode=19) in females.



Figures 2 to 7. 2) Lateral view of pronotum of *Boreus insulanus* showing position of bristles and appressed hairs. Gray bristle indicates position of occasional intermediate bristle. 3) Dorsal view of male *Boreus insulanus* hindwing and forewing. 4) Lateral view of male *Boreus insulanus* forewing and hindwing. 5) Lateral view of male *Boreus insulanus* genitalia. T=tergum; S=sternum. 6) Dorsal view of male *Boreus insulanus* genitalia. 7) Lateral view of *Boreus insulanus* ovipositor and adjacent segments, indicating position of setae, hairs and peg-like spines. Illustrations 3, 4, 5 and 6 by D. Young.

Thorax: Anterior margin of pronotum with two dorsolateral bristles and usually two lateral bristles; posterior margin with two dorsolateral, two lateral, and rarely, two sublateral bristles (Fig. 2). Pronotum with two obscure transverse furrows and covered by short recurved hairs, closely appressed to the surface. Mesonotum, metanotum and lateral thoracic sclerites without conspicuous bristles or hairs in male. Females with a pair of short, cruciate bristles near center of mesonotum.

Legs: Colour of coxa same as adjacent lateral sclerites; remaining leg segments lighter

brown to yellowish. Stout, dark brown, apicofemoral spine present. Anterior faces of coxae and trochanters with abundant long white hairs. Remaining leg segments covered in short, fine hairs and armed on ventral surface with two rows of evenly spaced, short, fine, erect setae. Each tibia with two apical spurs. All tarsi with two simple, terminal claws. Ratio of lengths of foreleg to midleg to hindleg approximately 1 : 1.3 : 1.7. Hindleg approximately 1.5 times body length in males; in female about equal to length of body including ovipositor.

Wings: Male forewings darker brown than thorax; outer margins distinctly narrowed near middle in dorsal view (Figs. 3 and 4). Length of wing 1.60 to 2.13 mm (avg 1.83 mm). Each forewing bears 17 to 24 (mode=18) strong, black, slightly twisted, outer spines starting about one-third of length from base and increasing in size from 0.05 mm to 0.11 mm at the wing tip. Inner forewing spines similar in shape, size and position to outer spines, and numbering between 17 and 26 (mode=19) on each wing. Terminal forewing spine strongly incurved and about the same length as pronotal bristles (0.16 mm). Forewing rugulose and covered by fine hairs, recurved and closely appressed to the dorsal surface. Hindwing light brown and tubular in basal four-fifths and becoming black and flattened at point of sharp incurving to tip. Middle portion of hindwing bears 7 to 12 (mode=10) short, stout spines with longer fine hairs intermixed. Distal half of hindwing before curved tip with felt-like pad of short, yellow to orange hairs. Female forewings short (avg 0.4 mm), oval, brown and covered with fine hairs, recurved and closely appressed to the surface. Hindwings very small and completely overlapped by the forewings.

Abdomen: Terga and sterna dark brown to almost black with metallic green sheen and densely covered in short, fine, semi-erect, posteriorly directed hairs that are clearly visible when backlit. Intersegmental membranous areas white. All segments with unfused terga and sterna. Female abdomen clearly larger in diameter than male but otherwise similar for segments 1 to 7.

Male genitalia (segments 8 to 10): Segment 8 unmodified, similar in appearance to segment 7 (Fig. 5). Tergum 9, sternum 9, basistyles and dististyles very dark brown to black. Sternum 9 long, extending to junction of basistyle and dististyle, and bearing a shallow, but distinct, notch along the posterior margin. Tergum 9 in profile with low hood that acts as a receptacle for the tips of the dististyles. In dorsal view the hood appears as a U-shaped ridge, forming a cup-like invagination, surrounded posterolaterally by the denticles (Fig. 6). The hood bears long, fine, pale hairs on the inside vertical surfaces (also visible in lateral view) and a pair of median bare areas, separated by a septum, where the dististyles touch. Denticles and surrounding cuticle black and difficult to see, especially when dististyles retracted into hood. Number of denticles ranged from 17 to 32 (mode=20) on each of the denticular areas of tergum 9. Dististyle with sharp tip, a medial, thumblike projection and a medial row of 14 to 21 (mode=21) short spines along inner margin. Tergum and sternum 10 small, oval, brown sclerites each bearing a few fine hairs. Membranous gonopore situated ventrally to the more prominent anus and usually hidden in the retracted state.

Female genitalia (segments 8 to 11): Configuration of terminal segments similar to females of other *Boreus* species (Fig. 7). Tergum 8 with fine transverse wrinkling and nearly encompassing segment 8, the sclerite ending just before venter where the valvulae emerge. Tergum 9 smooth and shorter than preceding and following segments. Segment 10 about 1 mm in length, equal to the length of the maxillolabial complex, and lacking hairs or setae on dorsal surface. A few scattered setae present on dorsal surfaces of segments 8, 9 and 11. Segment 11 and cerci fused into short, triangular segment. Ventral ovipositor valves (valvulae of segment 8) with numerous long, fine, white hairs on basal

2/3 to 3/4; replaced by about 30 to 40 evenly spaced, short, peg-like spines in terminal region. These spines lack emergent terminal hairs evident in other species (Penny, 1977; Byers, 1999) but longer hairs are occasionally present between the peg-like spines.

DIAGNOSIS

Presence of pronotal spines, notched sternum 9 of male, male wings narrowed near middle and configuration of male genitalia place this species in the *brumalis* subgroup with *B. nix*, *pilosus*, *brumalis*, and *bomari*. It is distinguished from these other species by the following combination of characteristics: head and abdomen dark brown to black with a distinct metallic green sheen, wings darker than brown thorax, legs light brown to yellowish and clearly lighter than thorax; fine hairs above eyes, on pronotum, and wings, recurved and appressed to surface; pronotal margins with two or four anterior and four posterior bristles, these bristles strong, dark and slightly curved; pronotum lacking erect, pale, intermediate length setae or hairs; distinct, erect hairs also absent from wings, occipital area, and sclerites of thorax and abdominal segments 1 – 8; 17 to 24 outer forewing spines; 17 to 26 inner forewing spines; 17 to 32 denticles; 14 to 21 dististyle spines; antenna with 19 to 22 flagellar segments; ovipositor equal in length to maxillolabial complex; tergum 10 of female without dorsal hairs or setae; terminal peg-like spines of valvulae without emergent hairs.

ETYMOLOGY

The latin word for "islander", *insulanus*, was chosen to indicate the apparent restriction of the species' range to Vancouver Island.

DISTRIBUTION AND HABITAT

This species is apparently confined to Vancouver Island and is currently the only *Boreus* species known from the island (Penny 1977 ; Blades unpublished data). Collection locales are situated along the interior mountain range of Vancouver Island at elevations from 300 to 1500 m. Like other *Boreus* species, it is believed to be associated with mosses.

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REFERENCES

- Byers, G.W. & S.R. Shaw 1999. A new species of *Boreus* (Mecoptera: Boreidae) from Wyoming. *Journal of the Kansas Entomological Society* 72(3): 322-326.
 Carpenter, F.M. 1935. New nearctic Mecoptera with notes on other species. *Psyche* 42: 105-121.
 Cooper, K.W. 1974. Sexual biology, chromosomes, development, life histories and parasites of *Boreus*,

- especially of *B. notopterates*. A southern California *Boreus*. Part II. (Mecoptera: Boreidae). *Psyche* 81: 84-120.
- Courtin, G.M., J.D. Shorthouse, & R.J. West 1984. Energy relations of the snow scorpionfly, *Boreus brumalis* (Mecoptera) on the surface of the snow. *Oikos* 43: 241-245.
- Hagvar, S. 2001. Occurance and migration on snow, and phenology of egg-laying in the winter-active insect *Boreus* sp. (Mecoptera). *Norwegian Journal of Entomology* 48: 51-60.
- Hori, S. & Morimoto, K. 1996. Discovery of the Family Boreidae (Mecoptera) from Japan, with description of a new species. *Japan Journal of Entomology* 64(1):75-81.
- Penny, N.D. 1977. A systematic study of the family Boreidae (Mecoptera). *University of Kansas Science Bulletin* 51(5): 141-217.
- Plutenko, A.V. 1984. A new species of the genus *Boreus* (Mecoptera: Boreidae) from the Soviet Far East. *Zoologicheskii Zhurnal* 63: 778-781. (In Russian)
- Plutenko, A.V. 1985. New and little-known species of Mecoptera from the Soviet Far East. *Entomologicheskoe Obozrenie* 64: 171-176. (In Russian) [*Entomological Review* 64: 113-119]
- Shorthouse, J.D. 1979. Observations on the snow scorpionfly, *Boreus brumalis* Fitch (Boreidae: Mecoptera) in Sudbury, Ontario. *Quaestiones Entomologicae* 15: 341-344.